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bly struck with the fullness and accuracy of the description given by Prof. Lesquereux in 1874, in his volume on the "Cretaceous Flora." Further, the more we look at the work done by our late esteemed friend Professor Mudge, the more we are impressed with the carefulness of his observations and the general justness of his conclusions. Hugh Miller tells us that wherever he followed in the track of Sir Roderick Murchison, he found all that geologist's work exact—the outline correct; only details to be filled in. We believe it is so with Professor Mudge. What he did, *was* done, and can be taken as a starting point for succeeding geologists.

We have given some description, we have indicated some problems, but we cannot now stay longer IN THE DACOTAH, except to say that our description falls much below the beauty and the wildness of this region; and that the solution of these problems will add much, not only to our stock of knowledge, but also to the material wealth of this, the Central State.

NOTES ON THE GEOLOGY OF THE SPANISH PEAKS.

BY J. SAVAGE.

Like most volcanic mountains, the Spanish Peaks stand isolated and alone. They are twins, and are known as the east or west peaks. When seen from a distance, their outlines stand out sharp and pointed against the sky. The east peak is entirely volcanic and destitute of mineral veins, and is the smaller of the two.

The west peak has a volcanic nucleus, or cone, but has a thick outer covering or mantle of the later sedimentary rocks. This outer blanket of soft sandstone has, by the intense heat of the inner volcanic material, been metamorphosed into hard, silicious quartzite, in which are found many metallic veins of the precious metals, besides abundance of lead and traces of copper.

Cotemporaneous with the elevation of the Spanish Peaks, and radiating from them like the spokes from a gigantic wheel, are found a remarkable system of dykes. These dykes are composed of varying volcanic material, and stretch off into the surrounding country from ten to twenty miles in extent. They were thrust up through the soft, friable sandstones of the Colorado lignite, in a soft, doughy state, leaving the impress of the sandstone mould all along their entire length. Near the peaks, where the power of erosion is much greater than elsewhere, the sandstone mould has been worn away, leaving the harder and more silicious dykes still standing as plumb and straight as a masoned wall, from 200 to 250 feet high; while further out in the surrounding plains, they have weathered down into sharp, steep knobs and peaks, thus presenting a picturesque and varied outline to the surrounding scenery.

Fisher's Peak, near Trinidad, is a notable example of one of these dyke remains.

The dykes, as they enter the west peak, are said by the miners to be converted into true fissure veins, and from what I could learn during a short climb up the mountain, I should judge their conjecture to be true. These mineral veins seem to penetrate the entire mountain, and divide it up into regular sections.

Near the base of the mountain, one dyke often cuts another in two, showing the one thus cut to be the older, but still soft and plastic when the newer one divided it in twain.

In approaching the peaks we find the strata gently dipping toward them, as though the giving out from beneath of so much volcanic material as composes the peaks and the dykes had left an empty space below, now occupied by the depressed strata.

I know of no richer field for exploration by young geological students, in all the Rocky Mountain region, than these Spanish Peaks, and the lessons learned from their study may be summed up as follows:

1st. All sharp-pointed mountain-peaks, whether seen from near or from far (and we

might as well include the mountains in the moon—for there is no one to dispute it) are composed of hard, silicious rocks. Notably are volcanic mountains included in this category: for example, the Sierra Nevadas, and the volcanic mountains of the Pacific coast, as well as those of Europe and Asia. Another inference I would like to make in this connection is this: that all mountain-peaks as seen to-day, are but fragmentary remains of what were once vast elevated plateaus, or long, massive elevated ridges, worn away by the tooth of time, and the present peaks are only the survival of the hardest, while the softer parts it may be have long since disappeared in the bottom of the ocean.

2d. The mission of the dykes, thrust up as they are through the vast seams of lignite coal—and many of these dykes have, no doubt, never reached the surface—is to mineralize the coal, or make it ready for the coke oven and furnace, as well as the coal grate, in the habitation of man: for example, the coal mines of Trinidad and vicinity, as well as those immense seams of coal near Walsenberg, on the way to Veta Pass. Otherwise these coal seams would have been only black carbonaceous dust, like the coal now quarried in our Dacotah in Russell county, along the Republican river, and also in many coal seams east of the mountains in Colorado.

3d. The lesson of metamorphism, which is a very important one to the geologist. This is seen illustrated upon the west peak, where its entire surface of soft sandstone is changed to hard quartzite; and still further it is seen all along the line of the dykes, which came up hot and changed the adjoining sandstone into quartzite for a few feet only, when it fades out into its original softness, and is thus weathered into steep cliffs all along the dykes, peaks which now dot all the surrounding country.

NOTES ON SOME KANSAS MINERAL WATERS.

BY PROFESSOR G. H. FAILYER, STATE AGRICULTURAL COLLEGE.

Some years since, a farmer living in the eastern part of Riley county, this State, in prospecting for coal, drilled to a depth of 120 feet; then abandoned this boring and began another one something over 100 yards distant from the first. In the meantime the water had risen to within four feet of the surface. A four-foot ditch was dug; from this the water flows at a rate which the farmer estimates, by measuring the flow during a short period, at 800 gallons per hour. At the depth of 85 feet the second well began to flow from the top, giving a stream, I am informed, 1½ inches in diameter. The boring was continued to a depth of 180 feet. The water ceased to flow from the well, but a ditch two or three feet deep permitted the water to escape again. The capacity of the well is now 200 gallons per hour. Analysis of the waters of these wells gave the following results:

	No. 1.	<i>Grains</i>	
		<i>Grams</i>	<i>per U. S.</i>
		<i>per litre.</i>	<i>gallon.</i>
Calc. oxide (as bicarb.*), ...		.090295	5.2766
Calc. oxide (not carb.), ...		.553883	32.3673
Mag. oxide, ...		.096792	5.6561
Iron oxide (as bicarb.), ...		.004101	.2426
Sodium, ...		.008699	.5183
Sulphuric acid (SO ₃), ...		1.050101	61.3651
Chlorine, ...		.025060	1.4644
Silica, ...		.172785	10.0968
No. 2.			
Calc. oxide (as bicarb.*), ...		.103945	6.0746
Calc. oxide (not carb.), ...		.251383	14.6900

* Combined and free carbonic acid not determined.